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An introduction to TWG8: Affect and the teaching and learning of mathematics

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Introduction

The Thematic Working Group 8 (TWG8) ‘‘Affect and the teaching and learning of mathematics’’ has been in CERME since 2003 (CERME 3) and the contributions have led us towards understanding the field better as well as developing new questions that should be answered in the past 20 years. Our call for papers for CERME 13 listed a diverse example of topics and we had contributions with different but related topics. In this section, we would like to introduce the work that has been presented and discussed in TWG8 in CERME 13.

A total of 19 papers and 1 poster was submitted to TWG8 and all of them were accepted for presentation after a rigorous revision process. Two contributors could not attend to the conference; therefore, 17 papers and 1 poster were presented and all of them were accepted for publication in the conference proceedings after the final revision. The contributors were from institutions in Israel, Italy, Finland, Germany, Hong Kong S.A.R. (China), Hungary, Mexico, Norway, Spain, the Netherlands, and United Kingdom. While the studies were conducted mostly in these countries, research from China and Zambia was also presented by the contributors. We had several contributors who participated in our group for the first time.

We started with introducing our group and how we planned to work in the sessions, followed by the ice-breaking activity. Considering that there were several new comers, a review of previous work done in TWG8 was presented and contributors were given tasks to discuss the recent directions pointed in the presentation. We planned the next five sessions in a way that the contributions would be briefly presented (5 minutes) followed by a short discussion (3 minutes) to maximize small and whole group discussions. Each session focused on contributions under a specific common topic. In most sessions, each paper was discussed longer within the whole group and these discussions led to the whole-group discussion of all papers in a session. We enjoyed and benefited these discussions and did not attempt to initiate a small group discussion.

In the last session, we provided the contributors themes that were emerged during the previous sessions and they were asked to individually add their comments/questions/reactions that connects their papers to the themes. Then, they discussed these in small groups and shared their discussions with the whole group. This enabled us re-evaluate our studies in light of the discussions.

Reflection on prior research in affect

The past reviews by Panziara in CERME8 and Liljedahl in CERME11 TWG8 meetings, and the review of research presented in the past CERMEs in CERME13 in the first session by Gómez-Chacón indicated that (a) there is a growing attention to the clarification of concepts and to the mutual relationship between the concepts; (b) there is a trend towards the use of mixed methods in the research on affect; and (c) there is an emphasis on the approaching the collected data with an interpretivist stance.

The focus on affect has gained attention since McLeod (1992)'s review paper on the affect constructs. He addressed the major affect constructs as beliefs, attitudes and emotions and characterized them based on their stability and affective-cognitive properties. Beliefs were considered the most stable over time, the least affective and the most cognitive. Emotions were considered as the least stable, the most affective and the least cognitive, with attitudes in between beliefs and emotions. This categorization was followed by numerous research and elaboration within the affect researchers. CERME5 discussions in this group focused on clarifying definitions of the concepts, enhancing the field by new concepts and specifying the relationships between these concepts (Hannula et al., 2007). Hannula and colleagues (2007) identified motivation, rather than attitudes, as one of the major affect categories. In the following years, based on Hannula (2011)'s analysis of affect research in mathematics education in CERME7, affect constructs beliefs, motivation, and emotions have integrated both state and trait dimensions and social, psychological, and physiological dimensions in the presented contributions (Schukajlow et al., 2019).

Affect can also be viewed by focusing on (a) the object of the affect (such as mathematics or task performance), (b) the subject of the affect (such as teachers, students, or preservice teachers), and (c) valence (such as positive or negative) (Schukajlow et al., 2017). These characteristics can be addressed with acquisitionist or participationist theoretical approaches. Affect constructs are closely related to each other (Goldin et al., 2009; Gómez-Chacón et. al., 2023; Hannula, 2011) in systems and change in one construct results in change in the others. For example, if a student does not believe that he/she will be able to understand the mathematics topics taught in the classroom at home on his/her own, then he/she may have less motivation to revise the topics at home, develop an attitude of not spending time on homework, and feel more anxious when there is a demanding homework.

Gómez-Chacón, in her review presentation of the TWG8, summarized how the field has evolved as follows. There is now more emphasis on detecting students affect when they are in the classroom and engaged in mathematics. Researchers are now more actively involved in the research process as they take an actor's perspective rather than an observer's perspective and measuring different components of affect systems. Therefore, affective constructs and/or participants are not investigated in isolation, but they are approached with a multidimensional and multilevel approach.

Contributions in the TWG8

We had the opportunity to learn and discuss about interesting studies this year. There were three studies that specifically focused on task-related affect. Herset analysed the interaction between level marking of mathematics tasks and self-efficacy in students' choice of tasks with an experimental study. Spagnolo and Saccoletto focused on how students view difficulty of mathematical tasks.

Høgset and Van den Heuvel-Panhuizen emphasized that students' voice should be heard and presented their analysis of students' appraisal of mathematical tasks.

Emotions and anxiety were the focus in three studies. Ruiz presented a case study from Mexico about teachers' perceptions and beliefs about elementary students' mathematics anxiety. Jenßen and Roesken-Winter analysed preservice primary teachers' shame experiences in mathematics during teacher education. Smith and Fotou investigated the relationship between teachers' anxiety and their students' mathematics anxiety and mathematics confidence.

Problem solving affect was a focus in four studies this year. Sintema presented mathematical problem-solving beliefs of upper secondary school students with the curriculum reform perspective in Zambia. Báró, Kovács, and Kónya analysed whether a problem-based approach promotes mathematical engagement through students' favourite mathematics experience. Begué and Arnal-Palacián explored the affective domain in primary school students through mathematical problem solving. Viitala focused on collaborative problem solving in Finnish lower secondary mathematics classrooms and its effect on mathematics-related affect.

Four studies reported findings related to different aspects of affect. In their poster, Espina, Marbán, and Maroto presented a systematic review of studies on dyscalculia and affects towards mathematics. Zhang and Lam presented findings from a case study of mathematics teachers' mathematics educational values in teaching in Hong Kong. Haser investigated conceptions of quality mathematics education research and mathematics education researcher among doctoral supervisors. Rubio-Sánchez, Gómez-Chacón, and Gómez-Veiga analysed the relationships among mathematics beliefs, fluid intelligence, cognitive reflection and mathematics achievement in secondary school students.

Krawitz, Schukajlow, Wiehe, and Rakoczy presented their findings on the experiences of competence and autonomy in a teaching intervention on mathematical modelling. Ding and Radmehr focused on the emotional characteristics of students' attitudes towards mathematics. Andrà and Scalvini analysed trait- and state-like motivations, emotions and perceived competence of freshmen STEM students.

Evolution of the TWG

We had several young researchers this year in TWG8 and most of the contributors were first time attenders to CERME and TWG8. We had a little smaller number of contributions this year but several contributors who visited TWG8 report session indicated that their current studies have an affect dimension, which they plan to present in the next CERME. The number of contributions, on the other hand, enabled us to discuss the ideas presented in the studies in depth. There were new topics, such as affect in the case of students with dyscalculia, difficulty perception, shame experiences, and engagement, which proved to be worthwhile to investigate further. Most of the studies were about students but there were also those about teachers and even doctoral supervisors. Gender continued to be a part of our discussions in several studies. Several studies utilized sophisticated quantitative methods but we also had mixed methods studies with several instruments. New instruments, such as students' drawing of graphs representing their affect, were used for data collection.

Our discussions focused on different aspects of the studies in terms of both content and method. We are still dealing with the definitions of newer terminology, such as engagement, which is enriching

the field with fruitful discussions. Mathematics anxiety was discussed throughout the sessions with focus on different actors and their interaction with the students, such as the relationship between teachers' anxiety and students' anxiety, parent influence on anxiety, and anxiety in the case of task selection and shame. Task related affect provided a solid ground for the discussions of the relationship between the affect and the cognition. We are still bounded by our data collection tools; however, this brings a positive trigger and leads us to think about other possibilities as well as contextual issues that result in such limitations. Identifying limitations helps us to develop improved tools to address affect in our studies. We still call for more research on the relationship between affect and cognition, theorising, deepening new concepts, longitudinal and comparative perspectives, and research focusing on different groups of students such as students with special needs.

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